R E V I E W

by Prof. Stefka Hristova Bouyuklieva
Faculty of Mathematics and Informatics,
St. Cyril and St. Methodius University of Veliko Tarnovo
about the competition for acquiring the academic position of
"Professor"
at the Institute of Mathematics and Informatics,
Bulgarian Academy of Sciences,

Research area: 4. Natural Sciences, Mathematics and Informatics,
Professional field: 4.6 Informatics and Computer Science
Scientific specialty: Informatics (Data Protection, Internet of Things)

In the competition for the academic position of "Professor", announced in the State Gazette, issue 65/02.08.2024 and on the website of IMI for the needs of section "Mathematical Foundation of Informatics" at the Institute of Mathematics and Informatics at Bulgarian Academy of Sciences, as a candidate participates Associate Professor PhD Hristo Nikolov Kostadinov.

1. General description of the presented documents.

The presented documents are:

1. Application by Associate Professor Hristo Kostadinov for participation in the competition, 25.09.2024.
2. Curriculum vitae.
3. Diploma of completed master's degree from Sofia University.
4. Copy of a diploma for the acquired scientific degree "doctor" from the University of Electronic Communications in Tokyo, Japan, 2005.
5. Complete list of the scientific publications of the candidate.
6. List of scientific papers for participation in the competition.
7. Copies of the papers for participation in the competition.
8. Signed author's reference for the scientific contributions of the works.
9. List of citations.

10. Information on the fulfillment of the minimum requirements for the academic position " Professor" at IMI-BAS.

11. Transcript-extract from the protocol of the Scientific board of IMI-BAS for initiating the procedure.

12. Copy of the State Gazette with the announcement for the competition.

13. Certificate of work experience from IMI - BAS.

14. Two declarations.

2. General characteristics of the candidate's scientific activity.

Hristo Kostadinov participates in the competition with 15 publications. All articles are in English and were published after 2013. These publications were not used in the procedures for acquiring the educational and scientific degree "doctor" and the academic position "associate professor", for which the candidate also signed a declaration

All papers have co-authors, which show the candidate's excellent ability to work in a team, and his contribution to each publication is undoubted. However, I recommend that Assoc. Prof. Kostadinov also pay attention to independent work.

Hristo Kostadinov completed his master's degree (1999-2000) and doctoral studies (2002-2005), and then he also held a postdoctoral position at the University of Electronic Communications in Tokyo, which led to successful scientific collaboration with scientists from Japan. From the beginning of his career, the candidate has worked very actively with Prof. Nikolay Manev, with 9 of the publications in the competition being their joint work, some co-authored with other scientists. In the total list of publications, out of 36 titles, 28 are joint works with Prof. Manev. The remaining co-authors of Assoc. Prof. Kostadinov after 2013 are his PhD students (some of them already doctors) L. Kraleva, B. Tsvetkov, Zh. Zhelyazkov and Ts. Tsokov.

The publications are systematized depending on the editions and the corresponding number of points they bring in terms of the requirements for academic positions and scientific degrees, and this systematization is presented in a table in a separate document, and according to some indicators (for publications and for citations) the points exceed the minimum needed. The first 6 publications in the list are included in indicator group B (instead of habilitation thesis), and according to the reference the first one carries 12 points, and the other five carry 20 points each, a total of 112 points (with a required minimum of 100 points). However, the points

are multiplied by a factor of 3, not 2, so the sum should be 168 points. The publications presented for indicator group D can be grouped according to the points in the following way:

- Publications [12], [14] and [15] are in the Q1 quartile of Web of Science and should carry 75 (not 50) points each.
- Articles [7], [10], [11] and [13] do not have IF, but have SJR, and therefore carry 30 points each.
- Articles with numbers [8] and [9] carry 18 points each.

The total points in this group are 381 with a required minimum of 220 points.

A reference is presented for 24 citations with which Hristo Kostadinov participates in the competition, which bring him a total of 144 points.

In indicator group E, there are 50 points for supervising a doctoral student, 60 points for participation in national projects, and 60 points for participation in international projects, a total of 170 points, with a mandatory 150 points.

The metrics regarding the publication activity of Hristo Kostadinov in Scopus are as follows: 26 documents, 62 citations in 40 documents, h-index 4. The metrics in Web of Science are similar, again with h-index 4.

Hristo Kostadinov has not presented information for lectures and/or exercises led by him.

3. Analysis of the scientific achievements according to the materials submitted for participation in the competition.

I assess the contributions of the candidate's research as scientific and applied. I will stick to the areas that the candidate has indicated in his author's reference, namely:

1. Construction of codes over the ring $\mathbb{Z}_m$ and their application to flash devices, modulation and communication systems (papers [1-5], [12-14]).

The candidate's work on this topic is joint with Prof. Nikolay Manev, and therefore all eight papers on this topic are co-authored. The asymmetric limited-magnitude error correcting codes can be used to speed up the writing process to flash devices. Asymmetric errors in flash memories are very common. However, there are cases in which the possible error type includes both a symmetric and an asymmetric error.

In the works [1], [5] and [12] the problem of finding suitable codes capable of correcting the most common errors that occur in flash memories is studied. In [1] a new class of codes

over the ring $\mathbb{Z}_m$ was constructed, which correct an asymmetric error of the type (±1,2). The type of the verification matrix of these codes was found. In the next publication [5], a class of codes was constructed again over the ring $\mathbb{Z}_m$, which correct an asymmetric error of length 2. For some parameters, the obtained codes are optimal. The decoding complexity is linear, regarding to the code length, and can be used a look-up table to decode them. All these advantages of integer codes make them very suitable for their usage in practice. The publication [12] is also devoted to the construction of a new class of codes, but in this case $m = 2^n + 1$. Codes of this class correct single errors of type $(1,2), (\pm 1, \pm 2)$ or (1,2,3), typical for flash memories.

The papers with numbers [2,3,4,13] are devoted to research on triangular quadrature amplitude modulation (TQAM). In the TQAM constellation, the signal points are vertices of a lattice of equilateral triangles and the constellation is symmetric. In publication [2], the exact value of the error probability of one symbol for a TQAM communication scheme in the case of a Gaussian channel is calculated. In the next publication, the efficiency of code modulation based on the application of codes over the ring $\mathbb{Z}_m$ is studied. Upper and lower bounds for the symbol error probability in a Gaussian channel are obtained. Software for simulating communication based on 2^k −TQAM in a Gaussian channel for $k = 4,6,8$ is developed. In [4], the efficiency of a coded modulation scheme, again based on codes over $\mathbb{Z}_m$, but for a constellation of 2^{2m} points, is studied. In publication [13], six coded modulation schemes based on integer codes for HQAM constellations with 16, 32, 64, 128, and 256 points are proposed. Their performance in the case of communication through AWGN channel has been studied.

2. On Digital Watermarking for Audio Signals (publication [6]).

The authors (Hristo Kostadinov and his coauthor N. Manev) investigated the possibility of embedding watermarks robust against compression in musical audio files. The process of embedding and retrieving a watermark can be regarded as a binary communication channel. The statistics of the channel was investigated to give recommendation how to choose the embedding parameters and what error correcting codes to be used. The investigation covers the case of AAC and MP3 compression. The described method of embedding is based on a combination of key dependable dither modulation and Haar wavelet transform. The whole process for its embedding capacity and robustness was analyzed. A practical method for choosing the embedding parameters was proposed.

3. Applications of smart contract platforms, based on distributed ledger technologies (papers [7-10]).

After its introduction, the smart contract platforms got practical use when they become key part of the Ethereum public blockchain and defined the concept of distributed applications (dApps). Smart contract platforms, based on distributed ledger technologies (DLT), are used in various industries such as banking, government and law, healthcare, insurance, and transportation. One area of DLT and smart contracts could also be used is the area of the software lifecycle management (SLM). Complex SLM procedures involve many parties such as customers, software providers, technical and business consultants, auditors, hardware providers, third party software vendors, and others.

The work of the candidate on this topic explores the applicability of DLT-based smart contract platforms to support multi-party SLM processes for complex client systems. In [8], it is shown that smart contract platforms can be used to design and implement a distributed system based on modern DLTs to solve typical SLM problems in a trustless multi-party project environment. In [9], a distributed system based on a public blockchain is described and analyzed that can be used to stimulate research breakthroughs and collaboration. The research presented in the last paper on this topic shows that by using permissioned DLTs, multiple nodes are created, and it can be constructed in such a way that it solves some typical SLM problems in a multi-party project environment.

My personal impression of these works is that they are related to the management and administration of these systems, but not to the mathematical models, nor to any programming techniques that underlie the development of such platforms. I also found illustration 1 in the article [9] strange - it takes up more than half a page, and it is not clear what its relation is to the topic under consideration, nor how it helps to understand what the respective optimization consists of.

4. Internet of Things (papers [11], [15]).

In the modern world, electronic devices such as sensors and actuators, forming the Internet of Things (IoT), are widely applied in people's daily lives. The paper [11] presents a solution for monitoring and controlling carbon emissions from vehicles, which includes a hardware device that receives data related to carbon emissions from vehicles and cloud services for storage and analysis. As a result, carbon emissions are controlled through notifications and vehicle power limits. The hardware modules are flexible and easy to expand to work with different sensors and/or collect data from the standard on-board diagnostic bus or vehicle

sensors. The implemented cloud applications are microservices that are not locked by the provider and can run in different clouds. The advantages of this solution are: (1) high availability and speed when working with large amounts of data thanks to the cloud-based architecture, and (2) the ability to work with different vehicles and clouds.

In [15], a new technique for network dynamic distribution of interdependent microservices on mobile infrastructure nodes is proposed, which is applicable in practice. It consists of a general optimization model of MILP algorithm and its implementation in a cloud platform. The results show a reduction in the overall end-to-end network latency compared to the latest state-of-the-art technologies. In this study, the MILP model is extended with several contributions: (1) introducing a latency matrix for inter-module communication variable, a node availability region variable, and an objective function to minimize replica movements through mobile nodes, (2) the capacity and demand vectors are replaced by direct variables used in the constraints and objective functions, (3) the model execution flow is modified to support dynamic optimization of replica placements with mobile nodes.

4. Conclusion

The above gives me a reason to believe that Hristo Kostadinov is a highly qualified specialist who has proven his ability to conduct research at a high level. According to the presented documents, the candidate Hristo Kostadinov fulfills all the requirements of the law and the Regulations to it and the Regulations for the specific requirements for acquiring academic degrees and occupying academic positions at BAS and IMI-BAS. I strongly recommend the Honorable Scientific Jury to vote on a proposal to the Scientific Council of IMI - BAS to select **Hristo Kostadinov** for the academic position "Professor" in

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15.11.2024 Member of the scientific jury:

/Prof. Stefka Bouyuklieva/